

WHAT IS CLAIMED IS:

1 1. For use in wireless network communications system
2 comprising a plurality of base stations and a plurality of
3 mobile stations, an apparatus for determining a distance
4 from a base station to a mobile station, said apparatus
5 comprising:

6 a distance unit associated with said base station
7 wherein said distance unit is capable of determining a one
8 way travel time D of a signal from said base station to
9 said mobile station; and

10 wherein said distance unit is capable of multiplying
11 said one way travel time D by the speed of light to obtain
12 said distance from said base station to said mobile
13 station.

1 2. The apparatus as set forth in Claim 1 wherein
2 said distance unit is capable of determining said one way
3 travel time D from:

$$D = \frac{1}{2} [(two\ way\ travel\ time) - (random\ backoff)]$$

5 wherein said two way travel time is a time of travel
6 for a range signal to travel from said base station to said
7 mobile station and to travel from said mobile station to
8 said base station; and

9 wherein said random backoff is a time value of a chip
10 length of a random backoff parameter of said mobile
11 station.

1 3. The apparatus as set forth in Claim 2 wherein
2 said distance unit is capable of obtaining said two way
3 travel time by subtracting an arrival time of said range
4 signal at said base station from said mobile station from a
5 transmission time of said range signal from said base
6 station to said mobile station.

1 4. The apparatus as set forth in Claim 2 wherein
2 said random backoff parameter for said mobile station has a
3 chip length value between zero chip lengths and five
4 hundred eleven chip lengths.

1 5. The apparatus as set forth in Claim 4 wherein a
2 time value for one chip length value is eight hundred
3 thirteen and eight tenths nanoseconds.

1 6. The apparatus as set forth in Claim 1 wherein
2 said distance unit is capable of obtaining a distance from
3 said base station to said mobile station with a distance
4 resolution of approximately two hundred forty four meters.

1 7. The apparatus as set forth in Claim 2 wherein
2 said distance unit is capable of adjusting a value of said
3 two way travel time to correct a time difference of a
4 signal comprising one of: a multipath signal and a Doppler
5 shifted signal.

1 8. A wireless network communications system
2 comprising a base station and a mobile station, said base
3 station comprising an apparatus for determining a distance
4 from said base station to said mobile station, said
5 apparatus comprising:

6 a distance unit associated with said base station
7 wherein said distance unit is capable of determining a one
8 way travel time D of a signal from said base station to
9 said mobile station; and

10 wherein said distance unit is capable of multiplying
11 said one way travel time D by the speed of light to obtain
12 said distance from said base station to said mobile
13 station.

1 9. The wireless network communications system as set
2 forth in Claim 8 wherein said distance unit is capable of
3 determining said one way travel time D from:

$$D = \frac{1}{2} [(two\ way\ travel\ time) - (random\ backoff)]$$

5 wherein said two way travel time is a time of travel
6 for a range signal to travel from said base station to said
7 mobile station and to travel from said mobile station to
8 said base station; and

9 wherein said random backoff is a time value of a chip
10 length of a random backoff parameter of said mobile
11 station.

1 10. The wireless network communications system as set
2 forth in Claim 9 wherein said distance unit is capable of
3 obtaining said two way travel time by subtracting an
4 arrival time of said range signal at said base station from
5 said mobile station from a transmission time of said range
6 signal from said base station to said mobile station.

1 11. The wireless network communications system as set
2 forth in Claim 9 wherein said random backoff parameter for
3 said mobile station has a chip length value between zero
4 chip lengths and five hundred eleven chip lengths.

1 12. The wireless network communications system as set
2 forth in Claim 11 wherein a time value for one chip length
3 value is eight hundred thirteen and eight tenths
4 nanoseconds.

1 13. The wireless network communications system as set
2 forth in Claim 8 wherein said distance unit is capable of
3 obtaining a distance from said base station to said mobile
4 station with a distance resolution of approximately two
5 hundred forty four meters.

1 14. The wireless network communications system as set
2 forth in Claim 9 wherein said distance unit is capable of
3 adjusting a value of said two way travel time to correct a
4 time difference of a signal comprising one of: a multipath
5 signal and a Doppler shifted signal.

1 15. For use in wireless network communications system
2 comprising a base station and a mobile station, a method of
3 determining a distance from said base station to said
4 mobile station comprising the steps of:

5 determining with a distance unit associated with said
6 base station a one way travel time D of a signal from said
7 base station to said mobile station; and

8 multiplying said one way travel time D by the speed of
9 light to obtain said distance from said base station to
10 said mobile station.

1 16. The method as set forth in Claim 15 wherein the
2 step of determining with a distance unit associated with
3 said base station a one way travel time D of a signal from
4 said base station to said mobile station comprises the step
5 of:

6 calculating said one way travel time D from:

7
$$D = \frac{1}{2} [(two\ way\ travel\ time) - (random\ backoff)]$$

8 wherein said two way travel time is a time of travel
9 for a range signal to travel from said base station to said
10 mobile station and to travel from said mobile station to
11 said base station; and

12 wherein said random backoff is a time value of a chip
13 length of a random backoff parameter of said mobile
14 station.

1 17. The method as set forth in Claim 16 further
2 comprising the step of:

3 obtaining said two way travel time by subtracting an
4 arrival time of said range signal at said base station from
5 said mobile station from a transmission time of said range
6 signal from said base station to said mobile station.

1 18. The method as set forth in Claim 16 wherein said
2 random backoff parameter for said mobile station has a chip
3 length value between zero chip lengths and five hundred
4 eleven chip lengths.

1 19. The method as set forth in Claim 18 wherein a
2 time value for one chip length value is eight hundred
3 thirteen and eight tenths nanoseconds.

1 20. The method as set forth in Claim 15 further
2 comprising the step of:

3 obtaining with said distance unit a distance from said
4 base station to said mobile station with a distance
5 resolution of approximately two hundred forty four meters.

1 21. The method as set forth in Claim 16 further
2 comprising the step of:

3 adjusting in said distance unit a value of said two
4 way travel time to correct a time difference of a signal
5 comprising one of: a multipath signal and a Doppler shifted
6 signal.

1 22. The method as set forth in Claim 15 wherein said
2 distance unit determines a distance from said base station
3 to said mobile station in less than ten seconds.

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1 23. For use in wireless network communications system
2 comprising a plurality of base stations and a plurality of
3 mobile stations, a method for locating a mobile station in
4 an area between three base stations, said method comprising
5 the steps of:

6 determining with a distance unit associated with each
7 of said three base stations a one way travel time D of a
8 signal from each respective station to said mobile station
9 where

10
$$D = \frac{1}{2} [(two\ way\ travel\ time) - (random\ backoff)]$$

11 wherein said two way travel time is a time of travel
12 for a range signal to travel from each respective base
13 station to said mobile station and to travel from said
14 mobile station to each respective base station;

15 wherein said random backoff is a time value of a chip
16 length of a random backoff parameter of said mobile
17 station;

18 multiplying each respective one way travel time D by
19 the speed of light to obtain each respective distance from
20 each respective base station to said mobile station; and

21 identifying a location of said mobile station within
22 said area between said three base stations using said

23 respective distances of said mobile station from said
24 respective base stations.

1 24. The method as set forth in Claim 23 wherein said
2 location of said mobile station within said area between
3 said three base stations has a distance resolution of
4 approximately two hundred forty four meters.

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1 25. The method as set forth in Claim 23 wherein the
2 step of identifying said location of said mobile station
3 within said area between said three base stations using
4 said respective distances of said mobile station from said
5 respective base stations comprises the steps of:

6 providing said respective distances of said mobile
7 station from said respective base stations to a distance
8 unit within one of said three base stations; and

9 calculating in said distance unit a location of said
10 mobile station from said respective distances of said
11 mobile station from said respective base stations.

1 26. The method as set forth in Claim 23 wherein the
2 step of identifying said location of said mobile station
3 within said area between said three base stations using
4 said respective distances of said mobile station from said
5 respective base stations comprises the steps of:

6 providing said respective distances of said mobile
7 station from said respective base stations to a calculator
8 unit not located within said three base stations; and

9 calculating in said calculator unit a location of said
10 mobile station from said respective distances of said
11 mobile station from said respective base stations.

1 27. For use in wireless network communications system
2 comprising a plurality of base stations and a plurality of
3 mobile stations, an apparatus for locating a mobile station
4 in an area between three base stations, said apparatus
5 comprising:

6 a distance unit associated with each of said three
7 base stations wherein said distance unit is capable of
8 determining a one way travel time D of a signal from each
9 respective station to said mobile station where

10
$$D = \frac{1}{2} [(two\ way\ travel\ time) - (random\ backoff)]$$

11 wherein said two way travel time is a time of travel
12 for a range signal to travel from each respective base
13 station to said mobile station and to travel from said
14 mobile station to each respective base station;

15 wherein said random backoff is a time value of a chip
16 length of a random backoff parameter of said mobile
17 station;

18 wherein said distance unit is capable of multiplying
19 each respective one way travel time D by the speed of light
20 to obtain each respective distance from each respective
21 base station to said mobile station; and

22 wherein said distance unit is capable of identifying a
23 location of said mobile station within said area between
24 said three base stations using said respective distances of
25 said mobile station from said respective base stations.

1 28. The apparatus as set forth in Claim 27 wherein
2 said location of said mobile station within said area
3 between said three base stations has a distance resolution
4 of approximately two hundred forty four meters.

1 29. The apparatus as set forth in Claim 27 wherein
2 said distance unit is capable of calculating a location of
3 said mobile station from said respective distances of said
4 mobile station from said respective base stations.

1 30. The apparatus as set forth in Claim 27 further
2 comprising:

3 a calculator unit coupled to said three base stations
4 but not located within said three base stations, said
5 calculator unit capable of receiving from said three base
6 stations said respective distances of said mobile station
7 from said respective base stations;

8 wherein said calculator unit is capable of calculating
9 a location of said mobile station from said respective
10 distances of said mobile station from said respective base
11 stations.